Activity: **5.8**
Develop Functional Design

Responsibility: Project Team

Description: The software functional design describes how the software product will be structured to satisfy the requirements identified in the Software Requirements Specification. It is a description of the software structure, components, interfaces, and data necessary before coding can begin.

The software functional design is a model or representation of the software product that is used primarily for communicating software design information to facilitate analysis, planning, and coding decisions. It represents a partitioning of the software system into design entities and describes the important properties and relationships among those entities. Design descriptions may be produced as documents, graphic representations, formal design languages, records in a data base management system, and CASE tool dictionaries.

Within the functional design, the design entities can be organized and presented in several ways. The goal of this activity is to compile the design entities and their associated attributes in a manner that facilitates the access of design information from various viewpoints (e.g., project management, configuration management, quality assurance, and testing). Also, the design entities and their attributes must be described in terms that are understandable to the system owner and users.

Work Product: Each requirement identified in the Software Requirements Specification must be traceable to one or more design entities. This traceability ensures that the software product will satisfy all of the requirements and will not include inappropriate or extraneous functionality. Expand the Requirements Traceability Matrix developed in the Requirements Definition Stage to relate the functional design to the requirements. Place a copy of the expanded matrix in the Project File.

The following tasks are involved in developing the functional design.

5.8.1 Develop Functional Design Document
5.8.2 Conduct Functional Design Review

Task: **5.8.1**
Develop Functional Design Document

Description: The Functional Design Document defines the functions of the system in user terminology and provides a firm foundation for the development of the system design. The Functional Design Document should be written from the system owner/users' perspective. This document provides the owner/users with an opportunity to review and provide input to the software product design before system design work is completed.

Work Product: Prepare a draft Functional Design Document. Use the designs developed for inputs, outputs, user and system interfaces, and security controls as input to this document. Submit the draft document to the system owner and users for their review and approval. After making the changes needed to resolve problems found during the review, the approved Functional Design Document becomes an official agreement and authorization to use the functional design as the basis for developing the system design. Place a copy of the approved Functional Design Document in the Project File.

Review Process: Conduct structured walkthroughs as needed to assure that the Functional Design Document is accurate, complete, and describes the functional design in a manner that can be understood by the system owner and users.

The completion of the draft Functional Design Document is an appropriate time to schedule an In-Stage Assessment (ISA). The *In-Stage Assessment Process Guide* provides a description and instructions for conducting an ISA. A copy of the guide is provided in Appendix D.

Task: **5.8.2**
Conduct Functional Design Review

Description: The Functional Design Review is a formal technical review of the basic design approach. The primary goal of the Functional Design Review is to demonstrate the ability of the software design to satisfy the project requirements. The review should be a series of presentations by the project team to the system owner, users, functional area points-of-contact, and Quality Assurance representative. Vendors may be invited to participate in the Functional Design Review when an off-the-shelf software product or hardware item is being considered for the system architecture.

Conduct the Functional Design Review to perform the following verifications.

- Evaluate the progress, technical adequacy, and risk resolution of the selected design approach. Determine whether the approved design approach is being followed by the project team.
- Evaluate the progress, technical adequacy, and risk resolution of the selected test approach. Review the following items:
  - Organization and responsibilities of group conducting tests
  - Project Test Plan
  - Planned format, content, and distribution of test reports
  - Planned resolution of problems and errors identified during testing
  - Retest procedures
  - Change control and configuration management of test items
  - Special test tools not required as deliverables
- Evaluate the methodology to be used to meet quality assurance requirements.
- Establish the existence and compatibility of the physical and functional interfaces.
- Determine whether the functional design embodies all of the software product requirements.

Description, continued:

- Verify that the design represents software that can meet the functional, data, and interface requirements.
- Review the planned user interfaces to the software. Examples of the types of design information to review:
  - Operating modes for each display station. For each mode, the functions performed, the displays and controls used.
  - The format and content standards for each screen (e.g., data locations, spaces, abbreviations, the number of digits, all special symbols, alert mechanisms).
  - Control and data entry devices and formats (e.g., keyboards, special function keys, and cursor control).
  - The format of all data inputs and provisions for error detection and correction.
  - The format for all status and error messages and data printouts (e.g., formats, headings, data units, abbreviations, spacing, columns).
- Demonstrate any rapid design prototypes used to make design decisions.
- Identify potential high risk areas in the design and any requirements changes that could reduce risk.
- Review to assure that consideration has been given to optimizing the maintainability and maintenance aspects of the software product.

Review Items:

The following items should be considered for review and evaluation during the Functional Design Review. Be prepared to discuss in technical detail any of these items within the scope of the review.

- Functional flows. Indicate how the computer software functional flows map the software and interface requirements to the individual high-level components of the software product.

Review Items, continued:

- Storage allocation data. Describe the manner in which available storage is allocated to individual software components. Timing, sequencing requirements, and relevant equipment constraints used in determining the allocation should be included.

- Control functions. Describe the executive control and start/recovery features of the software product.

- Component structure. Describe the high-level structure of the software product, the reasons for choosing the components, the development methodology that will be used within the constraints of available computer resources, and any support programs that will be required in order to develop and maintain the software product and allocated data storage.

- Security. Identify the security requirements and provide a description of the techniques to be used for implementing and maintaining security within the software product.

- Computer software engineering facilities. Describe the availability, adequacy, and planned utilization of the computer software engineering facilities including both Government-provided and commercially available facilities.

- Computer software engineering facility versus the operational system. Describe any unique design features that exist in the functional design in order to allow use within the computer software engineering facility that will not exist in the operational software product. Provide information on the design of support programs not explicitly required for the operational system that will be generated to assist in the development of the software product.

- Development tools. Describe any special tools (e.g., simulation, data reduction, or utility tools) that are not deliverables, but are planned for use during software development.

- Test tools. Describe any special test systems, test data, data reduction tools, test computer software, or calibration and diagnostic software that are not deliverables, but are planned for use during software development.

Review Items, continued:

- Commercial resources. Describe commercially available computer resources, including any optional capabilities (e.g., special features, interface units, special instructions, controls, formats). Identify any limitations of commercially available equipment (e.g., failure to meet user interface, safety, and maintainability requirements) and identify any deficiencies.

- Existing documentation. Maintain a file and have available for review any existing documentation supporting the use of commercially available computer resources.

- Support resources. Describe the resources necessary to support the software product during engineering, installation, and operational state (e.g., operational and support hardware and software personnel, special skills, human factors, configuration management, testing support, documentation, and facilities/space management).

- Operation and support documentation. Describe the documentation that will be produced to support the operation and maintenance of the software product.

Work Product:

Create and distribute official meeting minutes for each session. The minutes should consist of significant questions and answers, action items and individual/group responsible, deviations, conclusions, and recommended courses of action resulting from presentations or discussions. Recommendations that are not accepted should be recorded along with the reason for non-acceptance. Minutes must be distributed to the system owner and users for review and notification of review performance as follows:

- Approval - indicates that the functional design is satisfactorily completed.

- Contingent Approval - indicates that the functional design is not considered accomplished until the satisfactory completion of resultant action items.

- Disapproval - indicates that the functional design is inadequate. Another Functional Design Review is required.